PAINTING *on the* FARM

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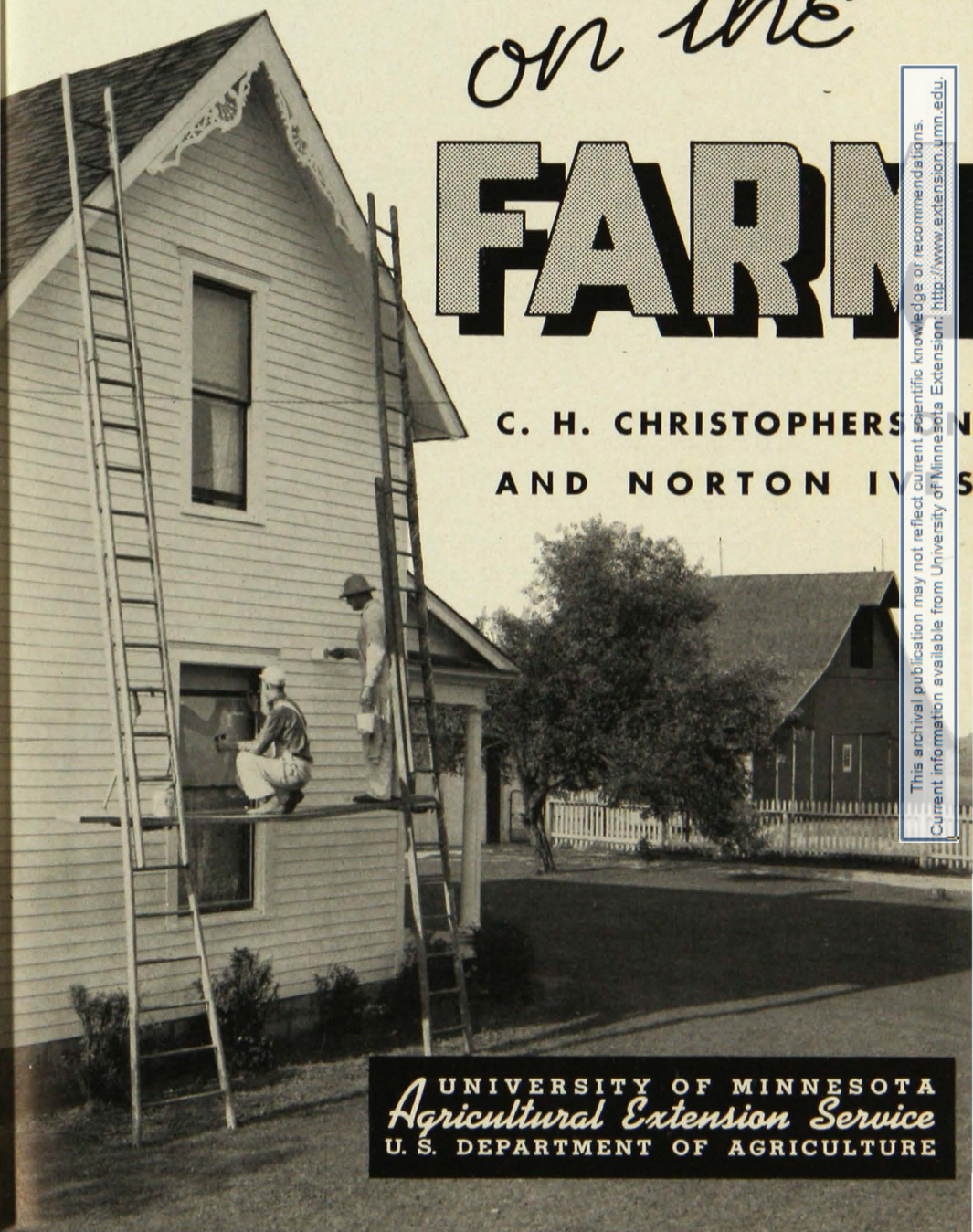

UNIVERSITY OF MINNESOTA
Agricultural Extension Service
U. S. DEPARTMENT OF AGRICULTURE

Avoid These Painting Errors

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Waiting too long before repainting, especially when a hard type paint (a paint high in zinc oxide) is used.

Using a low grade paint on anything but temporary structures.

Failure to select the right type of paint for the job.

Mixing two or more kinds of paint.

Failure to prepare the surface properly before applying the paint.

Allowing moisture to reach the back side of the paint film due to unnecessarily high humidity inside the building, absence of a moisture vapor barrier near the inside surface of the wall, or to cracks in the siding which allow rain water to enter.

Applying oil paints directly over surfaces that have had a previous creosote or asphalt coating.

Applying white and other light colors over dark colors such as brown, red, black, and green.

Applying soft paints over hard paints.

Applying paint when there is too much moisture on the surface or in the air.

Applying paint when the temperature is too high or too low.

Applying the paint too thick or too thin.

Failure to allow sufficient drying time between coats of paint.

Painting on the Farm

C. H. Christopherson and Norton Ives

DEVELOPING a painting program for farm buildings and equipment is worth-while on every farm. Buildings should be kept painted in order to improve their appearance and prolong their life. A set of well-painted farm buildings adds beauty to a farmstead and results in pride and greater satisfaction to the owner. Paint keeps metal from rusting and aids in preventing lumber from checking, warping, and decaying.

Many people consider painting a job requiring the knowledge and skill of an experienced painter. When skilled painters are employed, the labor cost often amounts to two thirds or more of the total cost of the paint job. Although in some cases it is desirable to employ skilled painters, much exterior painting can be done by unskilled or local farm labor if they will acquire certain fundamental knowledge of the proper selection and application of paint. Where the total cash outlay is essentially for materials alone, more farm buildings may be painted.

This bulletin presents information on selection of high quality paints and their proper application to the exteriors of farm buildings and to farm equipment.

A Successful Paint Job

A good paint job provides a hard, tough, and yet elastic paint film of the proper thickness to give maximum protection and present a good appearance for as long as possible.

Many factors affect the durability of a paint film or the quality of a paint job, but the following four requirements are the most important:

1. *Buy good paint.* Use a high quality ready-mixed paint made for a specific purpose or use a home-mixed paint made from properly combined high quality materials.

2. *Prepare the building and surface, if necessary, to prevent early paint failure.* Repair and maintain the building to keep moisture from getting to the back side of the paint film. Clean the surface of dirt and other foreign material. A cracked or seriously flaked paint film should always be removed before repainting.

3. *Apply paint properly.* Paint only when weather conditions are favorable. Mix and apply each coat of paint in such a way as to get a tough elastic film of the proper thickness. Use two or three coats of paint on new wood and one or two coats on repaint jobs.

4. *Plan a paint program.* No paint will last forever, so you must expect to paint again. Plan to paint at regular intervals in the future, the number of years between the paint jobs depending largely upon the type and quality of paint you choose. For best results the same type of paint must be used on repaint jobs as was used for the first job.

What Are the Ingredients of Paint?

PAINTS CONSIST of a solid called the **pigment** and a liquid called the **vehicle.** A paint should not be confused with a varnish or an enamel. A varnish is a transparent solution of gum resins in a fixed oil with a drier and thinner, and an enamel is a varnish to which a white or colored pigment has been added.

PIGMENTS

A pigment is a finely ground solid material which gives body and color to a paint. White pigments used in paints are classified as opaque and transparent. The opaque pigments give paint its color and hiding power. The transparent pigments have little or no color when mixed in oil and are used in paints chiefly to lower costs.

The opaque white pigments commonly found in paints are basic carbonate white lead, basic sulphate white lead, zinc oxide, and titanium dioxide. Titanium pigment is a mixture of 30 per cent titanium dioxide and 70 per cent transparent pigment. Zinc sulphide is also an opaque white pigment, but it is not generally used in the better grades of exterior white paints. It makes a good pigment for interior house paints and is usually mixed with barium sulphate and called lithopone.

The transparent pigments (sometimes called extenders) are used in large quantities in the cheaper paints. The following pigments are classed as transparent: calcium carbonate (limestone, chalk, whiting, marble dust), magnesium silicate (asbestine, talc), barium sulphate (barytes, blanc fixe), silica (silex, sand), calcium sulphate (gypsum, terra alba), aluminum silicate (kaolin, china clay), and magnesium carbonate. When these pigments are used to excess in paints, they lower both the hiding power and the durability of the paint. However, they produce a desirable effect when limited to small amounts as they help provide tooth or anchor for the paint film. They also increase the thickness of paint film and reduce settling of paint in the container. In general they should not exceed 10 per cent of the total pigment in white and tinted paints, and they should not exceed 70 per cent of the pigment in an iron oxide (red) barn paint. Titanium pigment paints, however, may exceed the 10 per cent limit for transparent pigments.

COLORING AND TINTING

Pigments, other than white, are used to color or tint the white base paints although a few of the pigments such as the carbon blacks, red lead, iron oxide, and aluminum are used to advantage alone. For obtaining red tints and shades, venetian red, iron oxide, and Indian red are used. Prussian blue and ultramarine blue are the most frequently used blues. For tans and browns the raw and burnt umbers and raw and burnt siennas are used. Yellow ochre and various shades of chrome yellow are used for the ivorys and yellows. The chrome greens are available in several shades. Carbon black, lamp black, and drop black are commonly used blacks.

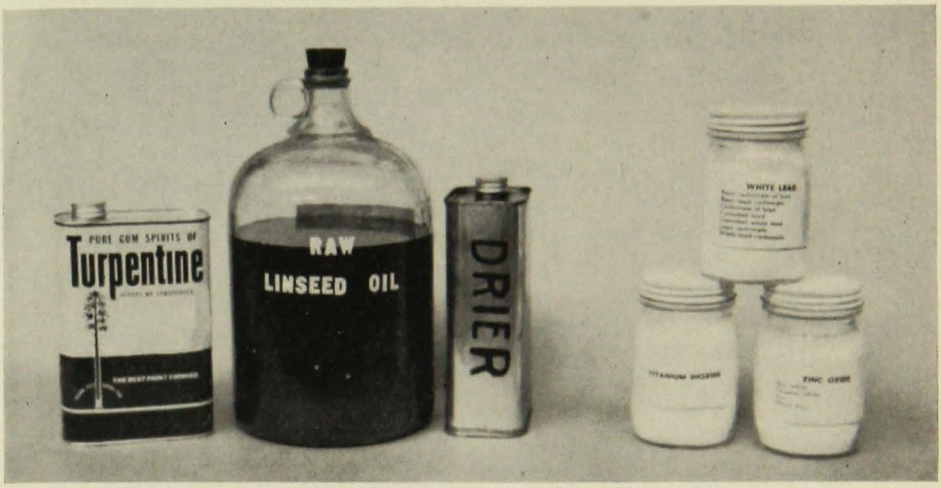


FIG. 1. CONSTITUENTS OF A HIGH QUALITY WHITE PAINT
(Left) Vehicle: Turpentine, Linseed Oil, and Drier. (Right) Pigment: White Lead, Zinc Oxide, and Titanium Dioxide.

VEHICLES

The vehicle, or liquid portion, of the paint usually consists of a drying oil, a volatile thinner, and a drier.

A drying oil is an oil which when exposed as a thin film to the oxygen of the air will dry to a hard, tough, yet somewhat elastic film. Sometimes semi-drying oils and low grade varnishes are used to replace all or a part of the drying oils in second and third quality paints.

The best drying oil for exterior paints is pure linseed oil. Small amounts of other drying and semi-drying oils such as soybean oil, perilla oil, treated fish oil, and tung oil may be used in paints, but they should be accepted only when placed in paints made by reputable manufacturers who know how to blend them properly with other ingredients.

The linseed oil may be either raw or boiled. The boiled oil has a drier incorporated in its manufacture which makes it unnecessary to add additional drier. Raw linseed oil is lighter in color than boiled oil and a drier should always be used with it.

A volatile thinner, such as pure gum spirits of turpentine or mineral spirits, is used to thin paints. Since a thinner soon evaporates it does not become a part of the paint film. Thinners make it possible to produce a flat finish in the second or body coat of paint so that the third or finish coat will adhere properly. Turpentine is generally preferred to mineral spirits, although there is little difference in their effect on the durability of a paint film.

Cheap paints frequently contain a considerable amount of kerosene, water, and other adulterants.

A drier is added to paint to hasten the drying. Too much drier will shorten the life of the paint as it causes the paint to dry too rapidly on the surface leaving the portion of the film just below the surface soft.

Planning the Painting Program

A COAT OF PAINT is like a suit of clothes in that it will gradually wear thin and have to be replaced, but unlike a suit of clothes a worn coat of paint cannot be easily cast off. Because new coats of paint must be placed over the previous paint, a definite painting program should be adopted and followed. Many paints will not give satisfactory service when used over other paints of radically different compositions. Therefore, it is important to choose a type of paint and a painting program that will give the best results and then follow that program.

One consumer may desire to repaint his house every third or fourth year in order to present the best possible appearance. In order to do this a paint of high hiding power should be used so that a single coat will be sufficient; otherwise the paint film would eventually become too thick and have to be removed.

The consumer who waits six to ten years between repaintings should use a soft type of paint, as a hard film could not be neglected for so long a time without leaving a surface that would be difficult to repaint.

A soft white paint is one that has a high per cent of white lead; it might even be 100 per cent white lead. A hard white paint is one that contains a considerable amount of zinc oxide.

Buildings painted with white and other light colored paints will require repainting more frequently than will those painted with the darker colors.

It is not enough to select the same brand of paint for each successive painting because paint manufacturers frequently change the composition of their paints while retaining the same brand name. It is best to record the composition of the paint used the first time and in the future always buy paint containing approximately the same kinds and proportions of ingredients.

PAINT FAILURES

A description and explanation of the various ways in which paints fail will be helpful in planning a painting program.

All exterior paints are subjected to severe punishment from the elements of the weather, such as the ultra violet rays of the sun and temperature and humidity changes. No paint film can be expected to last forever, but early failure or improper failure is most objectionable from the standpoint of cost, protection, and appearance.

Early failure may be due to the use of a poor quality paint, improper preparation of the surface, improper application, moisture getting behind the paint film, applying the wrong type of paint, or any combination of these factors.

Chalking.—The most desirable type of wear or failure for exterior oil paints is a gradual chalking away of the pigment caused by the breaking down of the drying oil in the paint. High quality paints fail in this manner leaving a surface that is smooth and easy to repaint, provided the repainting is done before more serious failure develops. Excessive chalking can be retarded by the addi-

tion of zinc oxide to the body and finish coats. For Minnesota climatic conditions the amount of zinc oxide, if used in outside white house paint, should be about 30 per cent of the total pigment.

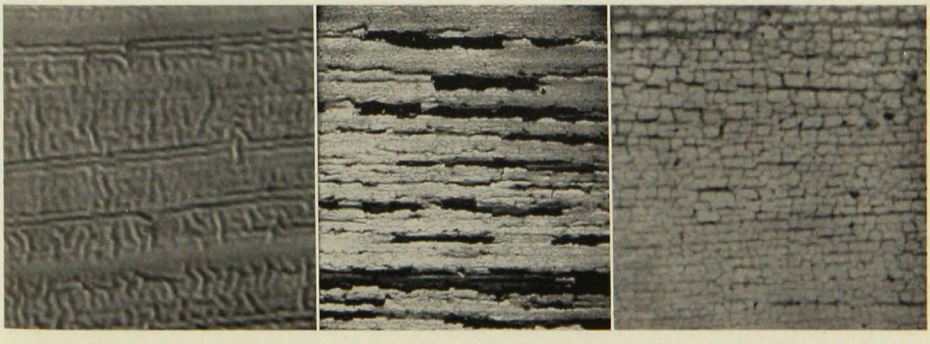
Wrinkling.—Wrinkling is caused by improper drying of the paint film. Too much oil in paint tends to favor wrinkling. A sudden drop in temperature during the drying period may cause wrinkling. In cold weather the paint should be applied in thinner coats even if an extra coat is required. If it is necessary to thin the paint use turpentine.

Cracking and Flaking.—As paint films age they become more brittle, and they will not follow the changes which take place in lumber due to ranges in temperature and moisture. As a result the film begins to crack and finally flakes off leaving areas without any paint. To retard this type of failure use thinner coatings and more elastic paints. The use of edge grain instead of flat grain lumber will also retard cracking and flaking.

Alligatoring.—Alligatoring is usually caused by the application of a hard drying paint over a soft drying paint. The differences in the expansion and contraction of the soft body coat and the hard finish coat causes the outer coat to form cracks and ridges. Alligatoring usually shows up quite soon after the paint has been applied. The remedy is to use less oil in the body coat and to use paints of proper types and proportions of pigments. Repainting over a hard type of paint with a soft paint may also cause alligatoring.

Moisture Failure.—When excess moisture comes in contact with the back side of a paint film, it usually causes the paint to separate from the surface. A rise in the temperature may cause the water behind the paint to expand and form a blister, and upon breaking open the paint will peel. Frequently just the outer coats will blister and peel; the priming coat may not be affected as it is more porous and may allow the moisture to pass through. The remedy is to prevent moisture from getting behind the paint film. Any cracks in the siding, around doors and windows, etc., should be repaired.

Where high humidities are found in buildings, there should be a vapor seal between the interior of the building and the exterior paint. The most positive



Wrinkling Cracking and Flaking Alligatoring

FIG. 2. WAYS PAINTS FAIL

and least expensive method of preventing condensation within the walls of new buildings, and moisture from reaching the back side of the paint film, is the use of vapor resistant barriers at or near the inner face of the wall. Among the materials that are highly resistant to the passage of water vapor are:

1. Lightweight asphalt roofing materials.
2. Asphalt-impregnated and surface-coated sheathing paper, glossy surfaced, weighing 35 to 50 pounds per roll of 500 square feet.
3. Laminated paper made of two or more sheets of kraft paper cemented together with asphalt, 30-60-30 grade.
4. Double-faced reflective insulation mounted on paper.

In houses already erected, two coats of aluminum paint composed of a high grade spar varnish applied to the plaster will serve as a vapor barrier. An oil paint of the color and finish desired may be applied over the aluminum paint.

The moisture problem can also be reduced by preventing high humidities in buildings through proper ventilation. Moisture in new plaster should be removed by proper ventilation and drying before the body and finish coats of paint are applied to the exterior of a building if a vapor barrier is not used in the construction.

Metal Stains.—Discoloration of light colored paints just below metal screens, flashings, and other metal parts on a building can be prevented by applying an exterior spar varnish or a coat of paint to the metal surfaces.

Incompatibility.—When two or more paints of distinctly different composition are used, one over the other, the paint may fail early. If this is due to the differences in the composition of the paints, the two paints are incompatible. This type of failure has occurred where white or light tints have been put over dark or full color paints or over a coat of yellow ochre. Mixing two kinds of paint might have the same effect.

Running and Sagging.—A paint containing two much oil may run or sag when applied to a painted surface. Applying paint to a glossy surface may also cause sagging. The remedy for this is to cut the gloss with fine sandpaper before applying the new coat. Glossy undercoats are not desirable as a base for additional coats of paint.

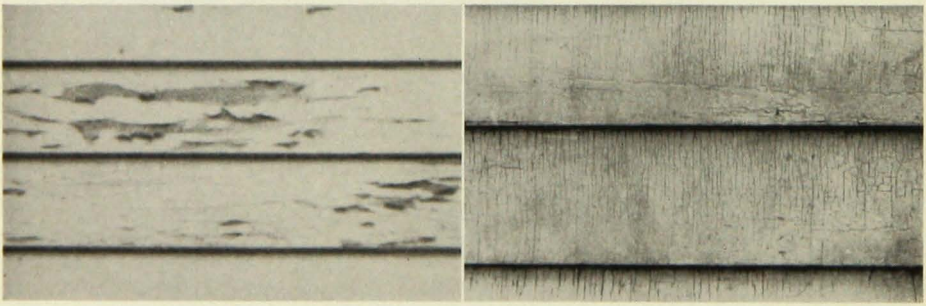


FIG. 3. MOISTURE FAILURE (LEFT) AND INCOMPATIBILITY (RIGHT)
Figures 2 and 3 Used Through Courtesy of Forest Products Laboratory

Selecting Paints for Farm Buildings

SOME THOUGHT should be given to the selection of appropriate paint colors for farm buildings. Attractive farmsteads give a great deal of satisfaction to the owners, and they are an asset to a community.

A set of farm buildings may all be painted the same color, or the house and garage may be of a different color. Whether to use a single color on a building or to use a different color for the trim is a matter for individual decision. A trim lighter than the body color tends to enlarge a building while a darker trim has the opposite effect.

Light colors tend to make a building look large while dark colors make it appear small. A small house on spacious grounds should be painted a light color, while a large house on a small building site should be painted a dark color.

A building should be painted with colors that harmonize with the surroundings and are in keeping with the architectural design. The landscape as well as adjoining buildings should be considered when selecting colors. Light colors always look well against a background of trees and shrubbery. White, dove, French gray, colonial yellow, cream or ivory, tan, buff, and pearl gray are all pleasing colors for houses. Darker colors such as black, India red, dark green, seal brown, and subdued blues may be used for trim, sash, screens, and shutters. Avoid the use of orchids, vivid reds, bilious greenish yellows, grass greens, and other colors which are too flashy for house paints.

Exposed metal parts, such as the eaves and downspouts, should be painted the same color as the part of the house with which they come in contact in order that they be less conspicuous.

PAINT COATS

In selecting paints one should keep in mind that each of the coats of paint on new wood should be formulated differently.

The priming coat (first coat) should penetrate the wood and partially satisfy the porosity of the wood. It should have enough pigment so that the second coat or body coat will completely hide the wood. Because of the high absorption of the oil by the wood, it is possible to use more oil in the priming coat and still have it dry with a flat finish.

The body coat should have a lower ratio of vehicle to pigment than the primer, and it, too, should dry without a high gloss in order that the third or finish coat will adhere properly. To make the body coat dry with a flat finish, a thinner such as turpentine or volatile mineral spirits is used along with the linseed oil.

The finish coat should be a gloss coat. A gloss coat is obtained by using linseed oil as the vehicle without a thinner or with a reduced amount of thinner. Sometimes a varnish is added to the paint to give it gloss. This is a questionable practice with white paints as too much varnish or a low grade varnish may lower the durability of the paint.

Special Primers.—There are numerous prepared paint primers and sealers available. Many of these primers are

intended for two coat paint jobs on new wood. Such primers and sealers should only be used as specified by the manufacturers. When correctly used they make a very satisfactory base for the following coat or coats of paint.

High grade aluminum paint consisting of either a long oil spar varnish or a bodied linseed oil vehicle makes a very satisfactory priming coat under oil paints and is superior to lead and oil as a primer over such woods as Douglas fir and southern yellow pine. When used under white and light tints, the body and finish coats will have to be of proper thickness to hide the color of the aluminum. Where the color is acceptable, aluminum paint can also be used as the body and finish coats.

At one time yellow ochre because of its cheapness was used extensively as a primer. **Yellow ochre is not a satisfactory primer and should not be used for that purpose.**

HOME-MIXED PAINTS

The chief advantages for home-mixed paints are the lower cost per gallon and the assurance of high grade materials in the paint. The chief disadvantages in mixing at home are the extra labor involved and the inexperience of the consumer in the selection and mixing of the paint materials. Another disadvantage is that where tints are used, it is sometimes difficult to duplicate a given color. Therefore, it is necessary to mix enough paint for the job at one time.

When selecting materials for making exterior house paints, one should purchase pigments in the soft paste form, pure linseed oil, gum spirits of turpentine, and Japan drier. For tinting white paint buy colors ground in oil.

READY-MIXED PAINTS

Most paint manufacturers make two or more grades of exterior paints. It usually is more economical and more satisfactory to buy the first grade paint although the second grade paint may serve quite well in some cases. Never buy the third grade paint. It will be an expensive paint to use regardless of the price you may pay for it. Many of the reputable paint companies make a third grade paint because consumers still demand a low price paint. If they did not have it, the business would go to a competitor.

All ready-mixed paints should be labeled giving the consumer the name and address of the manufacturer, the names and percentages of the paint ingredients, and directions for thinning and mixing the paint. The label should also indicate the use for which the paint is intended.

The consumer should beware of paints which claim to be an all-purpose or utility paint. The best paint for a specific type of painting is a paint made with the ultimate use in mind. The label should specifically name the ingredients and not use misleading terms such as: "vegetable oils," "boiled oil," "drying oils," and "pure oil." Paint should not contain more than a fraction of a per cent of water and, when present, it should be labeled "water" rather than "emulsion" or "emulsifying agent."

Figure 4 shows two labels found on white house paints. Label A indicates a high quality paint while label B is a very inferior product. Paint A weighs 17½ pounds per gallon and has 91.7 per cent opaque pigments, while paint B weighs but 12 pounds per gallon, and has only 42.1 per cent opaque pigments.

ANALYSIS

WHITE HOUSE PAINT

Composition by weight

Pigment	67.3 %
Vehicle	32.7 %
Total	100.0 %

Pigment

Basic white lead carbonate	49.08%
Basic white lead sulphate	10.92%
Zinc oxide	20.7 %
Titanium dioxide	11.0 %
Aluminum silicate	8.3 %
Total	100.0 %

Vehicle

Linseed oil	88.1 %
Turpentine and drier	11.9 %
Total	100.0 %

A

ANALYSIS

WHITE HOUSE PAINT

Composition by weight

Pigment	55.8%
Vehicle	44.2%
Total	100.0%

Pigment

Basic white lead sulphate	8.7%
Zinc oxide	16.6%
Zinc sulphide	16.8%
Barium sulphate	15.1%
Silicates	42.8%
Total	100.0%

Vehicle

Vegetable oils	61.1%
Water	17.5%
Drier and thinner	21.4%
Total	100.0%

B

FIG. 4. ALWAYS READ THE LABEL ON THE CAN
(A) A High Quality Paint; (B) An Inferior Product

HOUSE PAINTS

White lead is the only pigment which can be used alone in a high quality white paint, and it is the basic pigment in most white and tinted paints. A white lead and oil paint produces a film which can be neglected for long periods of time and still present a surface requiring little preparation for repainting. However, white lead and oil paints chalk more readily and do not present as glossy a finish as the harder type paints.

A mixture of white lead and zinc oxide gives a harder paint film. Zinc oxide also aids in preventing mildew on the painted surface. Titanium dioxide possesses the greatest hiding power of the opaque pigments, but because it produces a very soft film, zinc oxide and white lead should be used with it.

The following formulas of finish coats are suggested as an aid in selecting prepared exterior house paints. They are taken from specifications used by the Federal government in buying paint for its own agencies.

The thinner in these paints may be turpentine or volatile mineral spirits or a combination of the two. The linseed oil may be raw, boiled, or bodied or a mixture of these vehicles.

White Lead and Oil Paint

Pigment

100 per cent basic carbonate white lead

Vehicle

87 to 90 per cent pure linseed oil

10 to 13 per cent thinner and drier

The pigment should be 71 per cent of the total weight of the paint, and the paint should weigh not less than 19.5

pounds per gallon. Up to 2 per cent of the white lead may be replaced by high grade tinting pigments.

White Lead and Zinc Oxide Paint

Pigment

60 per cent white lead
30 per cent zinc oxide
Up to 10 per cent tinting colors and siliceous mineral pigments

Vehicle

87 per cent pure linseed oil
13 per cent thinner and drier

The pigment should be 66 per cent of the total weight of the paint, and the paint should weigh not less than 16.5 pounds per gallon.

White Lead, Zinc Oxide, and Titanium Dioxide Paint (White Only)

Pigment

58 per cent basic carbonate white lead
25 per cent zinc oxide
7 per cent titanium dioxide
Up to 10 per cent extenders

Vehicle

85 per cent pure linseed oil
15 per cent drier and thinner

The pigment shall be 68 per cent of the total weight of the paint, and the paint should weigh not less than 17 pounds per gallon.

BARN PAINTS

While red is not necessarily the preferred color for farm buildings, it is the most common. It is extensively used because a good quality red barn paint will cost less and last longer than high quality white or light colored paints. It is the iron oxide pigment in red barn paints that gives them their color and durability. The pigment should consist of 30 per cent or more iron oxide, while the balance may be one or more of the transparent pigments. About 15 per cent of the transparent pigment might be replaced by zinc oxide to increase resistance to mildew. Some good barn paints have a vehicle which contains varnish. The varnish aids in controlling penetration which is an important factor when painting rough or weather beaten surfaces.

A good gray or slate barn paint can be made by adding a black pigment ground in oil to a high quality white house paint. Any good house paint can, of course, be used on barns and miscellaneous farm buildings.

The Federal specifications for a prepared iron oxide paint state that the pigment should consist of at least 30 per cent iron oxide and not more than 70 per cent of siliceous minerals. Enough carbon pigment may be added to give the desired shade. The vehicle should contain not less than 75 per cent linseed oil, the balance being a mixture of thinner and drier. The thinner may be turpentine or volatile mineral spirits or a mixture of the two. A red barn paint should weigh not less than 12 pounds per gallon. From 53 to 57 per cent of the total weight should be the pigment. Barn paints may also be purchased in the paste form and mixed as directed by the manufacturers.

Selection and Care of Equipment

PAINT BRUSHES

Where paint is applied with a brush, three flat bristle brushes, one 1″ or 1½″, one 2½″ or 3″, and one 3½″ to 4½″ wide are enough for most exterior painting jobs.

It will not pay to buy low quality paint brushes as they neither hold sufficient paint nor spread the paint evenly over the surface. A high quality paint brush is costly, but if it is properly cared for, it will last two or three times as long as a cheap brush and will spread more paint in less time.

The things to look for in a good paint brush are high quality bristles, long bristles, and many bristles. It is difficult to judge the quality of a bristle, but anyone can note the length of the bristles. Check the quantity of bristles by separating them and noting whether the center of the brush has bristles or is hollow. Cheap brushes have a wide wood or fiber block in the center of the bristles, while the better brushes have a narrow block which permits many more bristles in the brush. (See right hand illustration in figure 5.)

Give Brush Proper Care

Give a paint brush proper care at all times. Remove the short loose bristles and the dust from a new brush by pressing the bristles from left to right. Next wash the bristles in gasoline or naphtha. Shake the cleaning fluid out of the bristles before dipping the brush in the paint.

A brush that is not to be used for a few hours or overnight can be kept soft by suspending it in the paint or in raw linseed oil. Do not suspend the brush in water as water will injure the bristles.

Paint brushes which are used only occasionally should be suspended in

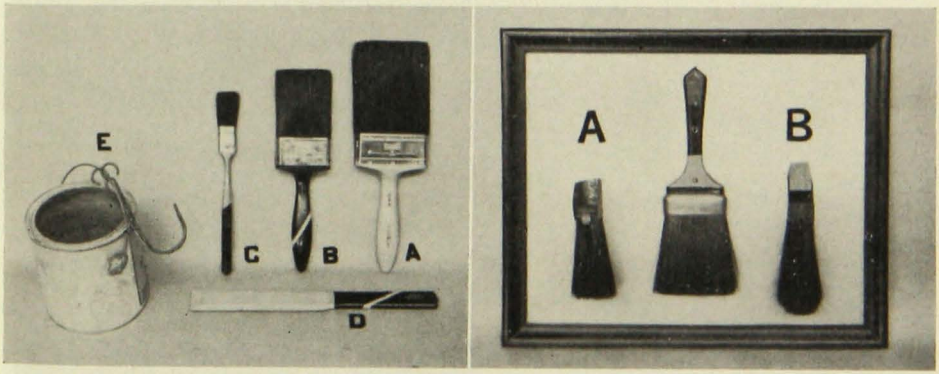


FIG. 5. (LEFT) PAINTING EQUIPMENT. A, 4-INCH BRUSH; B, 3-INCH BRUSH; C, 1-INCH BRUSH; D, STIRRING PADDLE; E, PAINT BUCKET AND SAFETY HOOK

(RIGHT) CROSS SECTION VIEWS OF (A) A POOR PAINT BRUSH AND (B) A GOOD PAINT BRUSH

raw linseed oil or a mixture of turpentine and raw linseed oil. The bristles should never touch the bottom of the container.

If a brush is not to be used for a long time, thoroughly clean it in gasoline, naphtha, or turpentine, and then wash in soap and water. When dry wrap in paper, keeping the bristles properly shaped.

Clean varnish and enamel brushes in turpentine or benzine only. Keep brushes used in shellac suspended in a closed container of denatured alcohol or wash them in alcohol and wrap in paper when dry. Brushes used in lacquer should be cleaned in lacquer thinner. Wash brushes used in casein paints, whitewash, and calcimine in cold water and then dry.

Reconditioning Brushes

A brush that has not been properly cleaned so that the bristles have become hard can sometimes be reconditioned by washing the brush in paint and varnish remover, followed by a thorough cleaning with turpentine and rinsing in gasoline or naphtha. If a brush is left too long in paint and varnish remover, the bristles will be ruined.

PAINT SPRAYERS

Spraying paint on large surfaces will save labor if the sprayer is operated by an experienced painter and if the outfit has sufficient capacity to maintain a constant pressure. A small spraying outfit in the hands of a farmer who paints about every five years generally will not be satisfactory.

OTHER EQUIPMENT

In preparing a surface for repainting, a wire brush and a wall scraper are essential. A blow torch may be used in extreme cases to soften paint so that it can be scraped off. For mixing paints several sizes of buckets or drums, flat wooden or metal paddles, cheesecloth or fine wire screen, and several volume measures should be provided.

An extension ladder and a set of ladder jacks are convenient in painting. A safety hook, which can be made from a piece of wire, is handy for attaching the paint bucket to the rung of a ladder.

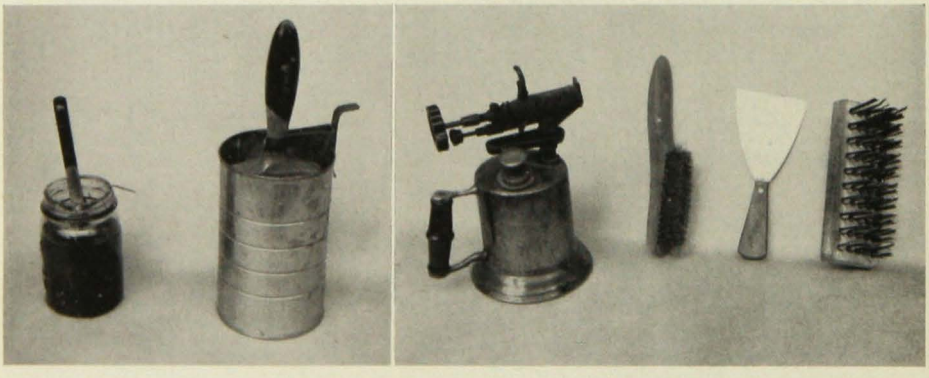


FIG. 6. (LEFT) KEEPING BRISTLES FROM TOUCHING BOTTOM OF CONTAINER (RIGHT) TOOLS FOR PREPARING SURFACE FOR PAINTING

Preparations for Painting

ESTIMATING PAINT REQUIRED

In order to estimate the quantity of paint required for a job, one must know the number of square feet to be covered, the number of coats of paint to be applied, and the desired covering capacity of each coat.

The covering capacity of any paint is influenced not only by the composition of the paint itself but also by the condition of the surface to which it is applied and by the individual who does the painting. On new lumber one gallon of exterior house paint should cover approximately 600 square feet first coat and 700 square feet each for body and finish coats. On two coat jobs over new lumber the paint should cover approximately 450 and 550 square feet per gallon for first and second coats, respectively. On repaint jobs over old paint that is in fair condition, one coat spread at about 600 square feet per gallon or two coats at 800 and 900 square feet per gallon, respectively, will give best results. Rough surfaces and weather-beaten lumber will require considerably more paint than a smooth surface. Two coats are recommended for such surfaces with spreading rates of approximately 300 and 450 square feet per gallon for first and second coats, respectively.

PREPARING THE SURFACE

Unpainted New Lumber

After the priming coat has been applied and dried and before applying the body and finish coats of paint to new lumber which has large knots or pitchy places, seal such defects with shellac which has been thinned with alcohol. Fill nail holes and cracks with putty after the priming coat of paint has dried.

Old Lumber and Painted Surfaces

Before applying paint to an old building, replace all badly split, worn, or decayed boards with new lumber. Any indication of dampness in the lumber to be painted should be checked to determine the source of the moisture. Flashings, eave troughs, and cracks in the siding around doors and windows are likely places for moisture to collect and saturate the wood. Correct any defects in construction before repainting. Renail all loose boards and drive in all protruding nail heads. Wash off with gasoline any soot, grease, or oil on the lumber or on the paint. Inspect windows and replace all loose putty. Always apply a priming coat of paint to the sash before puttying, or the wood will absorb the oil in the putty causing the putty to crumble and come loose.

Remove all loose paint by using a wire brush, wall scraper, or a blow torch. The blow torch should only be used where the condition of the old paint is extremely bad as it takes an experienced person to operate the torch so as not to burn or otherwise injure the siding or the building materials behind the siding. The torch should soften the paint to the point where the wall scraper will be able to remove it. Sandpaper can be used to smooth old surfaces before repainting. After scraping, sanding, or using the wire brush,

go over the surface with a duster to remove all loose dirt and dust.

Another method for removing old paint is with a paste paint and varnish remover. This is rather slow but does not involve the dangers connected with the use of the torch.

To avoid excessive work in preparing a surface for repainting, use high quality paint of the proper type for the painting program decided upon. Waiting too long between repaint jobs or repainting too frequently with thick coats of paint are the chief causes of bad paint surfaces. Sometimes a repaint job can be deferred and still have the building maintain a clean appearance by washing the old surface with plenty of clean water.

MIXING THE PAINT

Ready-Mixed Paints

Ready-mixed paints settle in the container and must be thoroughly stirred before they can be applied. Some paint stores have a device for shaking the paint in the container at the time it is sold. A good method for mixing paint is to "box" or pour the paint from one container to another. Stirring the paint with a wooden or metal paddle is also helpful.

There should be directions on the container for thinning the paint. Where no directions are given, it is usually good practice to thin the priming coat with one pint of linseed oil and one pint of turpentine for each gallon of paint. The second or body coat can be thinned with one pint of turpentine to the gallon of paint, and the finish coat may be applied without thinning.

Paint that has been previously opened will probably require straining through cheesecloth or fine wire mesh screen to remove dried paint film. The difficulties caused by a skin or film that forms on the top of a partially filled paint container can be controlled by tightly closing the container and turning it upside down.

Home or Job-Mixed Paints

For a home-mixed exterior white or tinted house paint, always buy the basic carbonate white lead in the soft paste form, as pigments in the dry form are difficult to mix. Stir the paste in the container until all the oil has been worked into the white lead. After removing the quantity of white lead required, cover the remainder with raw linseed oil and replace the cover.

Place the white lead paste in a container sufficiently large to hold the oil, thinner, and drier which will be needed. Add the required amount of raw linseed oil while stirring, and part of the turpentine next. Add the balance of the turpentine and the drier just before using the paint. If you are using boiled linseed oil instead of raw oil, omit the drier.

If a tint is wanted, always use a color ground in oil and add enough to the white paint to get the desired tint. Be sure to mix up enough of the tinted paint to complete the job as it is difficult to match the color later. Stir in the color as soon as the paint is thin enough to pour well and before adding the drier or all of the turpentine. Thin the colors ground in oil with turpentine for ease of mixing into the paint. Any lumps of color left in the paint will make streaks on the painted surface. Always strain the paint just before using. Remember that colors may change in intensity when they dry.

Table 1. Proper Proportions and Types of Ingredients to Use in Mixing Exterior House Paints

	New Wood			Repainting (2 coats)		Repainting (1 coat)
	Primer	Body	Finish	Body	Finish	
Soft paste white lead*	100 lbs.	100 lbs.	100 lbs.	100 lbs.	100 lbs.	100 lbs.
Pure raw linseed oil	4 gals.	1½ gals.	3 gals.	2 gals.	3 gals.	2 gals.
Pure gum spirits of turpentine	1¾ gals.	1¼ gals.	0	1¾ gals.	0	⅓ gal.
Liquid drier†	1 pint	1 pint	1 pint	1 pint	1 pint	1 pint
Approximate yield in gallons	9 gals.	6 gals.	6¼ gals.	7 gals.	6¼ gals.	5⅔ gals.

* If a heavy paste white lead is used, add 1 quart of turpentine for each 100 pounds of paste.
† The drier should be omitted if boiled linseed oil is used.

Table 1 gives proper proportions and types of ingredients to use in mixing exterior house paints for average painting conditions.

PAINT AT RIGHT TIME

On newly constructed buildings apply the paint as soon as possible in order that the lumber will not weather too much. The priming coat can usually be applied as soon as the siding and the trim are in place. If a house is kept closed while drying out the plaster with artificial heat, the moisture in the plaster may be forced out through the walls and get at the paint from behind causing it to blister and peel. It is, therefore, necessary to postpone the application of the body and finish coats until the plaster has dried unless a barrier of vapor-proof paper has been placed between the plaster and the paint.

Repaint Promptly

Repainting should be done as soon as the old paint fails to protect the surfaces. To postpone repainting too long will usually prove costly as the surface may require considerable treatment before it can be satisfactorily painted again. High quality house paints will usually give suitable service for three to five years while good red barn paints will last several years longer.

Do not apply paint when the temperature drops below 50 degrees; best results will be obtained if the temperature is between 60 and 80 degrees. Paints may sag or run if the weather is too hot. It is best to paint on the shady side of a building when the temperature is high.

Never apply oil paints when excessive moisture is present. Always wait until the sun has thoroughly dried the moisture on a surface before starting to paint and always allow ample time for each coat of paint to dry before proceeding with the next coat. Three to four days is usually a safe allowance for paint to dry, but weather conditions will influence the drying time. The presence of insects or dust in the air may ruin an otherwise good paint job.

Applying the Paint

THE VERY BEST paints will not give satisfactory service if they are not properly applied. Two methods of application are commonly used—hand brushing and spraying. Hand brushing is the method most frequently used on the farm. As to durability, when the thickness of the resulting paint film is the same, there is little or no difference between the two methods. The spraying method will waste from 5 to 10 per cent of the paint but approximately ten times as much paint can be applied per day as can be applied by brush. Since labor is usually a larger item than the cost of the paint, it is more economical to spray than to hand brush wherever the amount of painting to be done will warrant the initial investment in a spray gun. Because of the cost and because of the experience required to operate a gun, it is common practice to find this type of painting being done by experienced men who travel from farm to farm with their equipment. Sometimes several farmers purchase a spray gun cooperatively.

HAND BRUSHING

Before applying any paint make certain that the paint has been properly formulated, thoroughly mixed, and is free of any foreign matter. Properly mixed paint will still require occasional stirring while being applied.

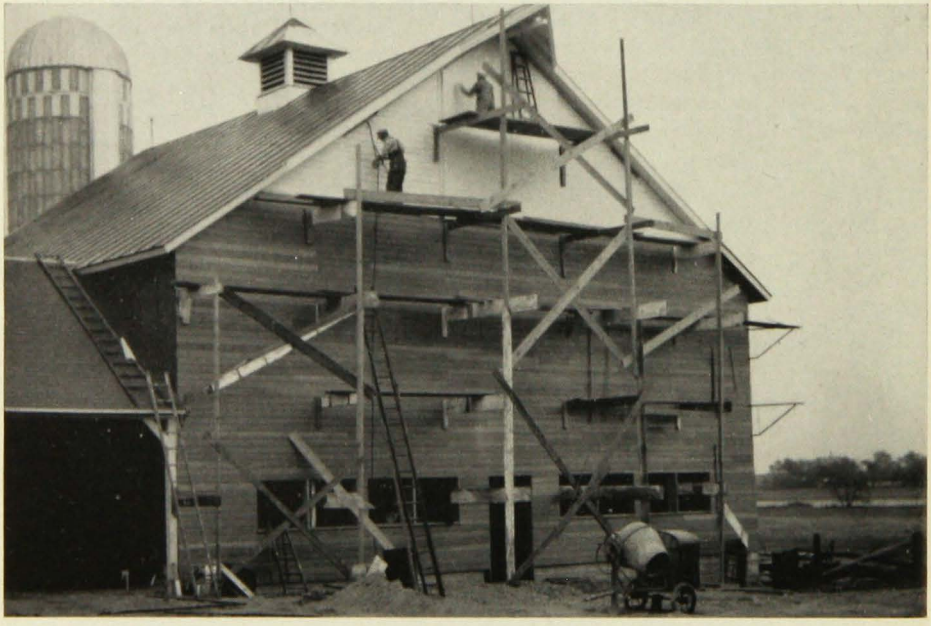


FIG. 7. PAINT BEFORE STAGING ON A NEW BUILDING HAS BEEN TORN DOWN

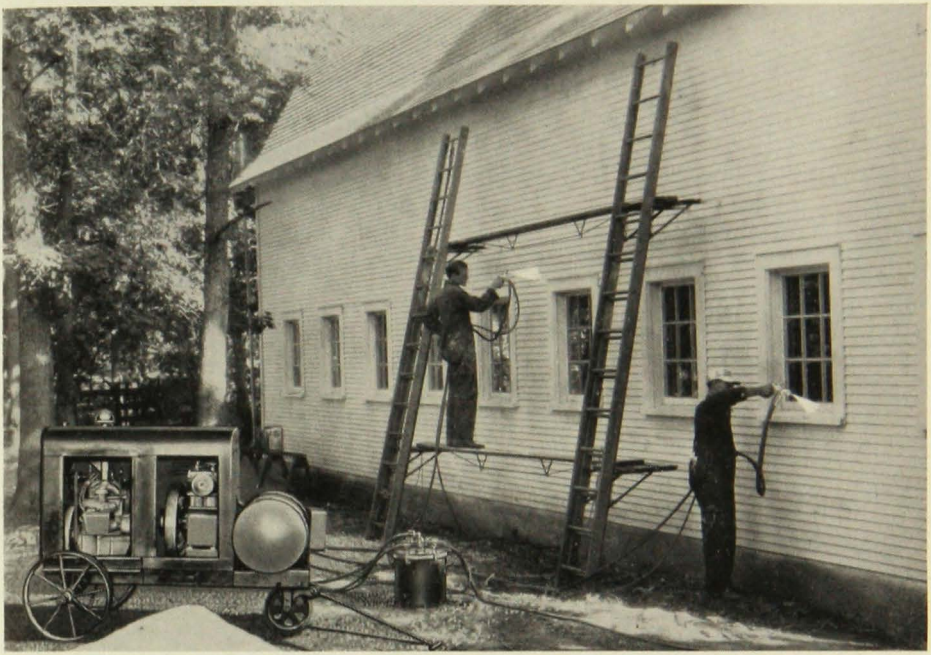


FIG. 8. SPRAYING PAINT IS SUCCESSFUL WHEN SPRAYING OUTFIT HAS SUFFICIENT CAPACITY AND THE GUNS ARE IN THE HANDS OF EXPERIENCED OPERATORS
Ladder Jacks Make Horizontal Movement Possible

Each coat of paint should be carefully brushed out. Avoid extra thick coats of paint as they do not dry properly and they usually cause more difficulty in preparing a surface for repainting. Also avoid getting the paint film too thin as thin coats will only protect the surface for a short time. The total thickness of the paint film, whether it be two or three coat work, should be about 1/200 of an inch or about the thickness of a sheet of newspaper.

In painting bevel siding or shingles, paint the edge or bottom with a half-filled brush, but use a full brush on the exposed face. Apply the paint to the unpainted portion first. After brushing out the paint evenly, feather the edges by gradually lifting the brush as it goes from the area just covered into the previously painted area. To avoid laps in painting, always stop work at natural divisions of the surface being painted.

Start at Top

Start painting at the top of a surface and at one edge working across and down. The use of ladders and ladder jacks is an improvement over painting directly from a ladder. On a new building the staging can often be used as a painting platform, and sometimes staging is necessary for repaint jobs. Staging should always be strongly built, using well-braced sound material.

Painting Metal Surfaces

STEEL, IRON, TIN PLATE, and other metals subject to rusting which are used in building construction, in farm machinery, and in barn equipment, should be protected by the use of proper paints or other types of coatings.

If a metal surface is properly cleaned of all grease, oil, dirt, and rust by wire brushing and washing with gasoline, it can be successfully painted. The surface must be dry when the paint is applied.

PRIMING COAT IMPORTANT

The most important phase of painting metal is the priming coat. This primer should be a rust-inhibiting paint such as red lead and oil. Red lead can be purchased as a powder, as a paste, or as a prepared paint ready to use. Formerly the paste and prepared forms tended to harden in the container if stored too long, but this tendency has largely been overcome by improved manufacturing methods. The powder or dry red lead should be mixed a day or more before using in order to wet completely the lead particles with the oil.

Red lead and oil should not be used alone for the body and finish coats on metal as it is costly and will fade badly. However, it can be used if it is tinted with a dark pigment. It is best to use a darker coat for the finish coat than for the body coat in order to tell readily which areas have been painted. For better retention of gloss it is advisable to add about a pint of high grade exterior spar varnish to each gallon of oil paint for the finish coat on metal. Red lead paint should have ample time to dry between coats. A week is not too long.

Aluminum paint having a long oil spar varnish vehicle makes a very good finish coat on metal because of its durability and heat-reflecting characteristics. **Aluminum paint should not be used as a primer on metal.**

Unpainted metal, unless galvanized, should receive three coats of paint and most repaint jobs will require two coats. Oil paints on smooth metal surfaces will cover from 600 to 700 square feet per gallon with one coat.

Two widely used formulas for a priming coat of red lead and oil are as follows:

100 pounds soft paste red lead
1⅞ gallons raw linseed oil
2½ pints turpentine
2½ pints drier
(makes 4½ gallons)

100 pounds dry red lead
3⅛ gallons raw linseed oil
2½ pints turpentine
2½ pints drier
(makes 5¼ gallons)

GALVANIZED STEEL

Steel which has a heavy coating of galvanizing will last a long time before it starts to rust. However, if the protective coating fails, it will rust. Much of the steel used on roofs and side walls of buildings has less than the commonly accepted 2 ounces of zinc per square foot and may need paint soon after application.

Paint will not readily adhere to new galvanizing unless the metal has been

pretreated at the factory; therefore, it is economical to let the sheets weather from 8 to 12 months before painting. If the untreated type must be painted when new, apply to the metal a wash coat of 4 ounces of copper sulphate in a gallon of water. This will etch or roughen the surface so that the paint will adhere. Leave the copper sulphate solution on the surface for about one hour and then wash off with clean water. Allow the metal to dry before painting.

TWO COATS SUFFICIENT

Two coats of paint should be enough on galvanized metal. One of the best primers for galvanized metal is a zinc dust paint with a pigment consisting of 80 per cent zinc dust and 20 per cent zinc oxide. The vehicle should be 90 per cent raw linseed oil and 10 per cent thinner and drier.

Old galvanized steel which has rusted should be primed in the same manner as new metal, but the surface should first be wire brushed and cleaned. The surface must be thoroughly dry before applying any paint. After the metal has been properly primed, it may be painted with aluminum paint or any good house or barn paint.

FARM MACHINERY

Metal parts on farm machinery will rust in the spots where the paint has worn away unless the machinery is kept painted. Numerous tractor and implement enamels are available which contain a high quality spar varnish which resists wear much better than exterior house and barn paints.

After properly preparing the surface, apply rust preventive primer under the implement enamel if the old enamel has worn through to the metal. Rust preventive primer can be purchased or a red lead and oil primer may be used. Two coats of enamel are usually required over the primer.

The wooden parts of farm machinery can be varnished with a high grade spar varnish or covered with implement enamel. If farm machinery is stored in a machine shed, it may go many years before repainting is needed.

METAL BARN EQUIPMENT

The high humidities and ammonia fumes found in many barns are very hard on the paint applied to metal barn equipment. Such equipment should be kept painted so that it will not rust.

If it becomes rusty, it will be necessary to remove the loose rust with a stiff wire brush before repainting. Use a priming coat of red lead and oil, and follow this with two coats of enamelized paint or an aluminum paint having a long oil spar varnish vehicle. Ordinary house and barn paints would not resist the abrasion which the equipment is subjected to by the livestock nor would it resist the moisture as well as a paint containing a varnish vehicle.

Livestock must not be allowed to lick fresh paints containing lead. Once the paint is thoroughly dry, there is little danger of livestock consuming enough lead to poison them.

Masonry Finishes

THERE IS a growing demand for color in concrete work, and this demand can be satisfied at the time the concrete is made by including a mineral pigment in the mixture. A maximum of 6 pounds of pigment can be used for each sack of white portland cement. This method of coloring is used in constructing basement and terrace floors, walks, and ornamental projects.

PORTLAND CEMENT PAINT

Plain concrete and other masonry surfaces can be colored by applying two coats of portland cement paint. This paint is made by factory grinding white portland cement with colored pigments and other materials. It is in a powder form to which water is added at the time of application. Apply this type of paint while the surface is damp, and cure each coat of paint for several days by sprinkling with water. Do not use good paint brushes on rough masonry.

Portland cement paints are not easily injured by moisture and will not peel from the surface as oil paints do when moisture gets behind the paint film. Portland cement paints can be used on concrete, stucco, common brick, soft tile, limestone, or any other masonry materials having a porous surface. It should not be used on masonry floors which are subjected to much wear, nor should it be applied over an oil paint or a masonry surface saturated with grease. Thoroughly scrub grease or oil soaked surfaces with gasoline.

A surface showing efflorescence (a white deposit on the surface) should be scrubbed with a 10 per cent solution of muriatic acid and then rinsed with plenty of clean water. Portland cement paints can be purchased in a dry powder form ready to mix with water.

OIL PAINTS FOR MASONRY

On masonry surfaces such as brick, tile, stone, and smooth concrete, oil paints are satisfactory, provided the surfaces are dry, clean, and in good condition. New masonry should age several months after the initial curing period before it is painted in order to make sure that it is dry. Unless the surface has weathered for several months, it should have a wash coat of 2 to 4 pounds of zinc sulphate crystals dissolved in a gallon of water. Allow solution to dry 48 hours before painting.

A sealing coat and two additional coats of paint should be used on new work. One or two coats will usually be sufficient on repaint jobs. Prepared sealers and masonry oil paints, if of first quality, may be used. They should be applied as directed by the manufacturers. A gallon of oil paint will cover 300 to 500 square feet with one coat.

Interior concrete floors can be colored with a good grade of porch and deck enamel having an elastic long oil varnish vehicle which is very resistant to wear and to moisture. If the floor has not aged for several months, the alkali in the concrete should be neutralized by applying the zinc sulphate treatment. Three coats of enamel will give best results. Thin first coat with a pint of turpentine to a gallon of enamel.

WATERPROOFING MASONRY

When constructing basement walls, see that they are waterproofed on the outside before backfilling. This can be done by applying two thick coats of asphalt to the concrete surface below the grade level. Apply asphalt to dry concrete with a stiff brush and allow to dry for 24 hours. Then apply second coat. One gallon of asphalt covers about 75 square feet.

Waterproofing can also be accomplished by applying a portland cement plaster to the exterior side of foundation walls and to the interior surface of cisterns and water tanks. Dampen the surface before applying the plaster. Apply the plaster in two coats using a 1-2 mix. Each coat should be about ¼ inch thick. Scratch the first coat before it hardens to improve the bond between coats. Cure each coat with water.

There are on the market a number of products which can be mixed with cement, sand, and water and applied to the interior of a concrete wall to stop moisture from coming through. They are usually applied as a plaster coat with a trowel. Buy such products only from a reliable dealer who guarantees the waterproofing qualities.

Staining Shingles

IT IS SOMETIMES desirable to stain wood shingles which are used on the walls and roofs of buildings. Two types of stain are generally available, oil and creosote. Oil stains are the safest to use if one wishes later to change the type of finish. An oil stain is essentially a thin oil paint and can be had in a variety of colors. Creosote is a good wood preservative; hence, varying amounts of creosote are mixed with other liquids and pigments and sold as creosote stains. Frequently, however, the amount of creosote is so small that it is of little value as a preservative. Large amounts of gasoline and kerosene in a stain greatly lower the preservative values. Low grade shingle stains are likely soon to fade or wash off. Any stain containing a large amount of creosote would be the color of creosote, a dark brown or black. It is difficult to apply oil paints over creosote unless the creosote has weathered for a long time as creosote will bleed through paint and also retard its drying. An aluminum paint with an exterior spar varnish vehicle will seal creosote if it has weathered for sometime. Once creosote stain has been sealed, an oil paint can be applied over the sealer.

Shingle stains can be applied by dipping the shingle in the stain before applying, or by brushing after the shingles are in place. A gallon of shingle stain will cover approximately 150 square feet for the first coat and 200 square feet the second coat. Two coats of stain should be applied. The first coat might be a dip coat and the second coat a brush or spray coat. The dipping should cover about two thirds of the shingle's length at the butt end. Oil paints can also be used on shingles. Three coats should be applied. Painted shingles are more resistant to sparks from chimneys than rough shingles.

If one wishes to collect rain water from the roof, it is best not to put a finish on the shingles. The best grade of wooden shingles will last from 25 to 40 years without any finish.

Painting Precautions

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FIRE HAZARDS

Many of the materials used in paint are highly inflammable; therefore, keep paints, oils, and thinners away from all open flames.

Dispose of all oily waste and rags containing paints, oils, or thinners immediately by burning or by placing in a fireproof container. Spontaneous combustion has caused many fires where linseed-oil-soaked rags have been left in painter's pockets or placed in nonfireproof containers.

When using a blow torch to remove old paint, take utmost care to keep the flame away from cracks or holes in the surface in order not to set fire to inflammable building material below the siding.

LEAD POISONING

Paints containing lead-bearing pigments or vehicles are poisonous to both people and livestock. Such paints should not be used on the interiors of silos or water and food containers. Cattle, and calves in particular, are frequently poisoned from licking fresh lead paint from the surface of roadside signs, fences, barn equipment, and buildings. It is safer to use aluminum paint or other non-lead-bearing paints on calf pens, feed troughs, and similar equipment. Boiled linseed oil may contain lead, but raw linseed oil is not harmful to livestock.

The danger of lead poisoning to humans comes from the handling of food before eating when there is lead on the hands, or from the inhaling of lead-bearing dust or fumes when sanding, scraping, or spraying lead paints. One should wear a respirator when doing such work.

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